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Studies on Carychium of Cheboygan Co., Michigan, During the  
Summer of 1949.

H. Harry

### INTRODUCTION

Research activities during the period of 19 June to 13 August were carried on in Cheboygan County and environs, primarily for gathering examples of Carychium for morphological study. Notes on the life history and habitat of this genus were also taken, and the great wealth of other molluscan species, many new to the observer, could not be overlooked. These are of value not only for themselves, but also as material for comparative morphological studies, and as cohabitants of Carychium.

### COLLECTING

Twenty-two lots of Carychium were collected from Cheboygan and Emmet Counties. In several instances the lots are duplicated from the same station at a different date, since development of the life history studies indicated this as advisable. In all instances the associated mollusca were collected, though as yet only partial and tentative determinations have been done on these. A few non-Carychium stations were collected, for material for comparative morphology. During the early part of the season, Carychium was hand picked in the field. However, it was found that by bringing in a quantity of leaves (4 liters volume, about) of the habitat, and carefully picking them over, using a bright light, the yield is about 10 times that of hand picking in the field. Associated species are also found to be more numerous in species and individuals, by this method.

### HABITAT AND CULTURE METHODS

Ecological studies are considered tangential to the problem, and have been done very sketchily, though sufficient for the purpose. The habitat which gave the best yield of Carychium was found to be in Thuja forests, where some broad leaved trees are also present (birch, maple). Here Carychium may be found in moist depressions filled with decaying leaves from birch, maple and Thuja, or occasionally under beds of moss, but the spot found most likely to contain these small snails seems to be the woods pool, with some water, and containing decaying broad leaves, twigs, and other mulch. Carychium seems to be limited to a definite margin of these pools, where the leaves are moist, but not so wet as to lose their curvature and lie flat, appressed against each other. Thus, Carychium lives in the small interstitial air spaces, where the air is presumably saturated with water vapor.

These views were substantiated in the laboratory: Carychium crawling on a moist leaf carries the shell well elevated from the substrate, the columellar axis at a sharp angle with the horizontal, the plane of the aperture parallel with the substrate (true of all

growth stages). The tentacles are extended, bluntly tapering, short, not bulbed, but founded. However, if covered by a drop of water, the shell is pressed down against the substrate, is drawn along with difficulty, and the snail moves more slowly. The tentacles are contracted to small spheres (Cf. *Otinia?*). Thus the snail shows evident discomfort when immersed in water. Exact notes on locomotion were not taken, but it was noted that the foot is extremely short, tapering acutely behind, reaching just to the suture between body and penultimate whorl; the foot seems to execute a ~~step~~ 'measuring worm' tread, like some *Ellobiidae*, *Truncatella*, *Urocoptidae*, and unlike any *Limnophilous Basommatophora*.

In keeping these snails alive, Syracuse watch glasses were found to be poor containers: their small size allows too much evaporation. When the chips of leaves placed with the snails dry out, the snails quickly die; there seems to be no epiphragm formation, and no very general tendency to close the aperture by adhering to the substrate. But if the leaves were excessively moist, and the snail held between two leaves joined by surface tension of the water, they survived much better, though unable to move about.

Doubtlessly moisture toleration varies with temperature, but exact studies have not been done. The few temperature readings made in the field show the temperature of the substrate to be about 10 degrees lower than the (summer) temperature of the air above. In the laboratory, the cultures can be easily maintained in small fingerbowls, covered with glass and placed in a pan thru which is flowing tap water. This helps stabilize the temperature, and prevents undue evaporation. Moist leaves (birch, maple, aspen) were placed in the bowls as food and for cover. The snails are negatively phototropic to a marked degree. Apparently food consists of detritus scraped from the surface of wet, decaying leaves and wood; this imparts a brown color to the digestive tract, allowing it to be easily traced in the living animal, which is white and with no pigment other than the eyes: but at times, the liver has a light brown color, which may be due to nutrient material in the liver (~~what~~ what amount of intracellular digestion may there be?).

Cultures have been maintained for nearly 2 months in the laboratory, feeding normally. Reproduction (at least birth of young, for no copulation was seen) occurred also. Some cultures were lost by drowning, and some by becoming too dry.

The woods pool habitat described above is not the only one in which *Carychium* occurred, as may be seen from the following outline. Apparently the determining factor for *Carychium* is sufficient and constant moisture, but this is surely not the sole factor, for some spots, apparently ideal for *Carychium*, were found to be negative. A very general indication of habitat conditions, particularly to the malacologist with field experience, is given by the organisms associated with these snails. Of these, only the mollusca were collected with any thoroughness, and these have not been specifically determined as yet.

Habitat types for Carychium in Cheboygan Co., et environs.

1. Thuja swamp, some broad leaf trees (maple, birch) present. around margins of woods pools, under broad-leaf rubbish, sometimes where there is no water present in the depression but the "pool" is of constant moisture.

Station	Date	Locality	Key numbers (preserved material)	
III	20 June	Rees' Bog.	C1	C = <u>Carychium</u> material
IV	"	"	C2a	
I	2 July	"	C7, 412, 413	U = associated mollusca
II	3 July	S. end Long Lake	C4, 410	
I	14 July	Hay lake, margin	C11, 415	
III	23 July	Trail's End Bay	C15, 422	
I	17 July	Rees' Bog	C13	
II	"	"	C14	
I	28 July	"	C18, 428	
II	"	"	C16, 426	
I	30 July	Trail's End Bay	C-19, 429	
I	4 Aug.	Rees' Bog	C-21, 431	
II	"	"	C-20, 430	
I	7 Aug.	Trail's End Bay	C-22, 432	

2. Thuja swamp with mixed broad leaf tree, under a broad bed of moss (Mnium and Thuidium), along a small stream in Rees' Bog. (N.B. I have never found Carychium or any other snail in Sphagnum)

II 2 July Rees' Bog C6

3. Roadside ditch, low area, with grass and fern (Onoclea), growing under broad leaf forest (beach, maple) under leaves.

III 3 July S. End Long Lake C5, 411 //

4. Roadside shoulder, low grasses and fern (Onoclea), the Carychium found under a new, barkless fence post recently dropped in the grass. Area kept moist presumably from seepage from Mud creek, a few feet away.

II 7 July Mud creek. C8  
II 30 July " C17, 427

5. Under decaying leaves of grass (Carex sp.), at muddy ditch (no water) entering Mud Creek.

II 7 July Mud Creek Opposite side of the road from this station and date listed under type 4, above.  
C9

The non-molluscan associates, like the ~~XXXX~~ molluscan associates listed below, show themselves to be a mixture of terrestrial and aquatic forms: Ostracods, millipedes, centipedes, collembola, other insects, isopods, acarina, earth worms, nematodes, spiders and pseudoscorpions were noted.

The following constitutes a composite of associated molluscan forms, from all stations (except as noted). Identification tentative only.

<u>Triodopsis multilineata</u>	_____	Sta. III of 2 July only
<u>Vallonia excentrica</u> ?	_____	Sta II of 7 July only
<u>Deroceras</u> (white) cf. <u>reticulatum</u>	_____	"
<u>Deroceras</u> (brown) cf. <u>laeve</u>	_____	"
<u>Triodopsis albolabris</u>		
<u>Stenotrema leai</u> (group) (formerly <u>Polygyra monodon</u> gr.)		
<u>Cionella lubrica</u>		
<u>Gastrocopta</u> (several?)		
<u>Vertigo</u> "		
<u>Pupilla muscorum</u> ?		
<u>Striatura milium</u> ?		
<u>Punctum pygmaeum</u> ?		
<u>Hawaiiia</u> ?		
<u>Striatura exigua</u>		
<u>Planogyra asteriscus</u>		
<u>Helicodiscus parallelus</u>		
<u>Euconulus</u>		
<u>Strobilops</u>		
<u>Pallifera dorsalis</u>		
<u>Gyraulus</u>		
<u>Cossaria</u>		
<u>Musculium</u>		

Succinea ovalis  
S. avara.

Other  
habitats  
types,  
rather  
general

Aquatics

N.B. : Complete identifications will be furnished when completed, also specimens of forms not previously taken in this county.

#### MORPHOLOGY AND SPECIATION

(See also above) No definite example of heterostrophy has been noted, though the material needs to be checked more closely. It seems evident that the lower margin of the pulmonary cavity is at the margin of the aperture, the subpeplular cavity is all but occluded, and thus Carvchium compares with the Stylomatophora in this respect and contrasts markedly with Limnophilous Basomm. I was unable to relax the snails with menthol, though some relaxation was obtained by drowning overnight in water. This genus is capable of retracting several whorls into the shell. Only alcohol has been used as a fixative and preservative (70%). Usually the snails were dropped directly into it.

Considerable height-diameter variation and degree of sculpturing has been noted, and it is probable that statistical analysis will shed some light on the validity of C. exilis and C. exiguum, often noted in the literature as occurring together. The subspecies C. exilis canadensis is distinguished by being "uniformly larger", though no exact measurements of large series have been made as yet, and such speciation is extremely dubious, at least in a group so variable as the Basomatophora. However, there was some indication that the slender forms prefer a somewhat dryer situation than the tumid forms.

## LIFE HISTORY

Nothing previously known; the literature describes a veliger larva in some of the Ellobiidae, and I have seen it in Melampus. All the Basommatophora Limnophila deposit eggs in transparent gelatinous masses, and certain of the Stylommatophora living in moist situations do the same (Succineidae, the slugs).

No eggs ~~XXXX~~ were noted during the entire period of study, though eggs of some of the associated snails, even smaller than Carychium, were found. During the early weeks of field work, no immature forms were noted (except 2 or 3 dead shells, submature) though immatures of associated species (Punctum? even smaller than Carychium) were noted in the field.

On July 23, very young Carychium were noted in the field and a sack full of leaves picked over in the laboratory produced young in the ratio to adults of about 2-3:1. All these young were of ~~1 3/4~~ 1 3/4 whorls and less in size. Subsequent weekly collections have been made at the same locality (Emmet Co., Trail's End Bay), and though exact measurements have not been made as yet, it appears the maximum whorl size has gradually increased; the third week collection contains many individuals between ~~3 3/4~~ 3/4 ths grown and fully grown, though all smaller stages are represented. The small stages taken from this station at the later dates may be due to differential growth rate, ~~XXXXXX~~ and there is reason to believe the appearance of young ceases just as suddenly as it begins.

Over 40 adults were isolated in watch glasses, these ~~x~~ specimens collected 28 July, and only one produced young: 2 small specimens measuring 1 whorl each, were present the following morning. From all lots brought in later than 23 July, adults were isolated at least <sup>after 1 August</sup> overnight, often several days, yet no young have appeared. Though actual parturition was not observed, I suspect this snail is ovoviviparous, and has a brief period of reproduction in mid summer (last week of July). It is ~~suspected~~ <sup>suspected</sup> that examination of specimens brought in before 23 July, by clearing and by sectioning, may reveal advanced embryos, and those brought in after 1 August will show none. But is there another season of the year when the young are also produced? Does the time vary in different latitudes? How long is the period of gestation? When does copulation occur, assuming it does?

After 23 July, all Carychium stations visited showed immature specimens in the field; weekly collections were made at a station in Rees' Bog, as a check on the station in Emmet Co., and the Mud Creek station was revisited, where young were also found. At the latter station, it is probable young would have been noted earlier (7 July) had any been present.

*L. Harry*